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jc961 U.S. PTO
11/21/00

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	FA0972 US NA
First Inventor	DECKER ET AL.
Title	LOW GLOSS POWDER COATINGS
Express Mail Label No.	EK219418908US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

jc515 U.S. PTO
09/717413
11/21/00

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing)
2. ☐ Applicant claims small entity status. See 37 CFR 1.27.
3. ☒ Specification [Total Pages 15]
   (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to sequence listing, a table, or a computer program listing appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
4. ☐ Drawing(s) (35 U.S.C.113) [Total Sheets]
5. Oath or Declaration [Total Pages]
   a. ☒ Newly executed (original or copy)
   b. ☐ Copy from a prior application (37 CFR 1.63 (d)) (for a continuation/divisional with Box 17 completed)
      i ☐ DELETION OF INVENTOR(S)
      Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☒ Application Data Sheet. See 37 CFR 1.76
7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ paper
   c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATIONS PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 C.F.R.§3.73(b)Statement (when there is an assignee) ☒ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☐ Request and Certification under 35 U.S.C. 122 (b)(2)(B)(I). Applicant must attach form PTO/SB/35 or its equivalent
16. ☐ Other:

17. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:*

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____

Prior application information: *Examiner* _____ *Group Art Unit:* _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

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Country		Telephone		Fax	

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PTO/SB/17 (09-00)
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FEE TRANSMITTAL for FY 2001

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 710

Complete if Known	
Application Number	
Filing Date	NOVEMBER 21, 2000
First Named Inventor	DECKER ET AL.
Examiner Name	
Group / Art Unit	
Attorney Docket No.	FA0972 US NA

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 04-1928

Deposit Account Name: E. I. du Pont de Nemours and Company

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Applicant claims small entity status. See 37 CFR 1.27

2. ☐ Payment Enclosed:

☐ Check ☐ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filling fee	

SUBTOTAL (1) ($) 710

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims	9	-20** =	0	X		=	0
Independent Claims	2	-3** =	0	X		=	0
Multiple Dependent				X		=	0

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for ex parte reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive – unavoidable	
141	1,240	241	620	Petition to revive – unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	130	123	130	Petitions related to provisional applications	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	710	249	355	For each additional invention to be examined (37 CFR § 1.129(b))	
179	710	279	355	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0

SUBMITTED BY

Complete *(if applicable)*

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APPLICATION INFORMATION

Title Line One:: LOW GLOSS POWDER COATINGS
Total Drawing Sheets:: 0
Formal Drawings?:: No
Application Type:: Utility
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REPRESENTATIVE INFORMATION

Registration Number One:: 32177
Registration Number Two:: 36087

Source:: PrintEFS Version 1.0.1

TITLE OF INVENTION

LOW GLOSS POWDER COATINGS

Field of the Invention

The invention relates to powder coatings in general and, more specifically, to powder coatings that provide a low gloss appearance to the coated article.

Background of the Invention

Powder coatings are widely used to provide a decorative and/or protective coating on substrates. They are becoming increasingly popular because they are applied in a solid state or slurry. These application states mean that the powder coatings use little or no solvents, unlike their conventional liquid coating counterparts. In addition, solid state application permits the powder to be collected, purified and re-used.

In certain applications, it is necessary or desirable for the powder coating to have a surface that is smooth in appearance, but has a low gloss or shine. Such applications are those where low gloss is aesthetically desired, or where glare from the coating surface can interfere with the safe or proper use of the coated article, such as firearms, optical devices, military applications and motor vehicles, aircraft and other vehicles. Prior art attempts to control gloss in powder coatings has taken three different approaches using fillers, waxes and differential cure.

The addition of fillers is known to reduce the gloss of powder coatings. Indeed, gloss reduction is an unavoidable, and often undesirable, side effect of filler addition. For example, the 3M Company markets ceramic microspheres under the trade name Zeeospheres™ for use in powder coatings to control gloss. A filler commonly used for gloss control is wollastonite, whose needle-shaped crystals are very effective at reducing gloss by reducing the microscopic smoothness of coatings. Fillers of other shapes are also commonly used to reduce gloss. The shortcoming of the use of fillers to control gloss is that their addition also reduces coating flow, typically increasing the amount of waviness or texture known as "orange peel."

Hydrocarbon and fluorocarbon waxes are used to reduce the gloss of powder coatings. As a wax-containing coating is baked, the wax migrates to the coating/air interface where it forms a layer with reduced gloss. Shortcomings of this approach are that the wax softens the coating surface and reduces its resistance to marring, staining and chemical attack.

Another way to reduce gloss, which is especially effective with epoxy and epoxy/polyester hybrid coatings, is to incorporate at least two curing agents or two differently structured or differently-catalyzed resins. Upon incomplete molecular mixing, such as is typically encountered in a powder coating extruder, these differential-cure systems result in the development of zones of varying shrinkage or varying surface tension on the coating surface during cure, yielding a microscopically-rough layer which is seen as low gloss.

Variations of this approach are widely used. A shortcoming of this approach is that coating properties such as impact resistance, flexibility, or chemical resistance suffer.

Summary of the Invention

In one aspect, the invention provides an improved powder coating composition, the improvement wherein comprising the use in the composition of spheroidal particles having a mean particle size greater than 10 microns and preferably greater than 15 microns, and having a maximum particle size of about 50 microns.

In another embodiment, the invention provides a process of reducing gloss in a powder coating, the process comprising adding spheroidal particles to a powder coating composition, wherein said spheroidal particles have a mean particle size greater than 10 microns and preferably greater than 15 microns, and have a maximum particle size of about 50 microns.

These and other features of the invention will become apparent on a further reading of the application.

Detailed Description of the Embodiments

The powder coatings of this invention provide the formulator with an opportunity to control the gloss of the final coating while minimizing or eliminating the negative effects of the prior art attempts at controlling gloss; i.e., loss of coating flow and creation of "orange peel" surface effects. It is important to note that the coatings of this invention have a rough or textured surface microscopically, but otherwise appear smooth to the naked eye.

The powder coating compositions of this invention contain one or more thermosetting or thermoplastic resins commonly used in such coatings and well

known in the art. Such resins include those based on epoxy, polyester, acrylic and/or urethane resins. Examples of such resins include saturated and unsaturated polyesters, acrylics, acrylates, polyester-urethanes, acrylic-urethanes, epoxy, epoxy-polyester, polyester-acrylics and epoxy-acrylics. Useful thermoplastic resins may include nylon, polyvinylchloride, polyethylene, polyethylene terephthalate, polybutylene terphthalate and polypropylene, for example.

The powder coating compositions of this invention may be applied by electrostatic spray, thermal or flame spraying, or fluidized bed coating methods, all of which are known to those skilled in the art. The coatings may be applied to metallic and/or non-metallic substrates. Following deposition of the powder coating to the desired thickness, the coated substrate is typically heated to melt the composition and cause it to flow. In certain applications, the part to be coated may be pre-heated before the application of the powder, and then either heated after the application of the powder or not. Gas or electrical furnaces are commonly used for various heating steps, but other methods (e.g., microwave) are also known. Curing (i.e., cross-linking) of the coating may be a carried out by thermal or photochemical methods (e.g., ultraviolet radiation, infrared radiation, etc.). Curing may be effected by heat conduction, convection, radiation or any combination thereof.

The powder coating compositions of this invention contain spheroidal particles. The term "spheroidal" as used herein means generally spherical in shape. More specifically, the term means filler materials that contain less than 25% particle agglomerates or fractured particles containing sharp or rough edges. The spheroidal particles should be non-reactive or inert so as not to interfere with the other properties of the composition. Examples of suitable spheroidal particles are glass microspheres, ceramic microspheres, naturally-occurring or synthetic spheroidal minerals such as cristobalite, polymer microspheres and metal microspheres.

As already mentioned, the spheroid particles must have a mean particle size greater than 10 microns, preferably of greater than 15 microns. Intermediate ranges are included. As the mean particle diameter decreases, the surface per unit weight increases. The increase in surface area results in a tendency of the filler to dry the coating, reduce flow, and induce roughness in the coating. As indicated in the working examples, spheroidal particles having a mean diameter of 10 microns or below produced only marginal results in gloss control, whereas at mean diameters

greater than 10, particularly of greater than 15, the spheroidal particles gave good results.

The upper limit of the diameter of the spheroidal particles is dependent on the intended thickness of the final coating in that the particles must have a diameter less than the coating thickness. Most powder coatings, especially "decorative" powder coatings, are designed to be applied at a dry film thickness of about 50 microns. Thus, in most applications, the spheroidal particles should have a maximum diameter of less than about 50 microns, preferably 40 microns.

The spheroidal particles may be present in the composition in an amount of from 5 wt% to 60 wt%, based on the total weight of the powder coating composition. Below 5 wt%, little effect on gloss is observed. Above 60 wt%, an unacceptable loss of coating flow results. It is understood that these are general guidelines and the exact weight % of spheroidal particles will depend on the specific gravity of the spheroidal particles, the degree of gloss reduction desired and the other components of the powder coating composition.

In addition to the resins and spheroidal particles, the powder coating compositions of this invention may contain other additives that are conventionally used in powder coating compositions. Examples of such additives include fillers, extenders, flow additives, catalysts, hardeners and pigments. Compounds having anti-microbial activity may also be added as is taught in US 6,093,407, the entire disclosure of which is incorporated herein by reference.

The powder coatings of this invention are prepared by conventional manufacturing techniques used in the powder coating industry. For example, the ingredients used in the powder coating, including the spheroidal particles, can be blended together and heated to a temperature to melt the mixture and then extruded. The extruded material is then cooled on chill rolls, broken up and then ground to a fine powder.

The spheroidal particles may also be combined with the coating powder after it is formed in a process known as "bonding." In this process, the coating powder and the material to be "bonded" with it are blended and subjected to heating and impact fusion to join the differing particles.

EXAMPLES

Table 1 identifies a number of commercially available spheroidal particles and characterizes their usefulness as gloss control agents in powder coating compositions.

TABLE 1

SPHEROIDAL GLOSS CONTROL AGENTS

Glass Microspheres (Potters Industries, Inc, Valley Forge, PA)			
GRADE	MAX. DIA. (μM)	MEDIAN DIA. (μM)	GLOSS REDUCTION
Spheriglass™ 3000E	90% ≤ 60 μm	35	High[1]
Spheriglass™ 3000E screened at 45 μm	45	23	High
Spheriglass™ 10000E	6	3	Low (too fine)
Ceramic Microspheres (3M Corporation, Minneapolis, MN)			
G200 Zeeospheres™	12	4	Low (too fine)
G400 Zeeospheres™	24	5	Low (too fine)
G600 Zeeospheres™	40	6	Low (too fine)
W610 Zeeospheres™	40	10	Marginal (too fine)
G800 Zeeospheres™	200	18	High[1]
G850 Zeeospheres™	200	40	High[1]
G850 Zeeospheres™ screened at 45 μm	45	20	High
Cristobalite (C.E.D. Process Minerals, Inc., Akron, OH)			
Goresil™ C-400	100	9	Low (too fine)[1]
Goresil™ 1045	45	10	Marginal (too fine)
Goresil™ 835	35	8	Low (too fine)
Goresil™ 525	25	5	Low (too fine)
Goresil™ 215	15	2	Low (too fine)

Notes: 1. Useful only for coatings of thickness greater than about 50 microns.

<u>EXAMPLES 1-8</u>

The following examples illustrate the importance of the proper filler particle size on gloss control and coating smoothness. The spheroidal fillers listed in Table 3 were tested in the composition listed below in Table 2:

TABLE 2

TGIC-CURED POLYESTER COMPOSITION

Component	Parts by weight
Crylcoat 2988 Polyester Resin (UCB)	100
Araldite PT-810 Curing Agent (Vantico)	7.5
Modaflow III Flow Aid (Solutia)	1.3
Benzoin Degassing Aid (Estron)	0.5
R-960 TiO_2 Pigment (DuPont)	8.1
Raven 450 Pigment (Columbia)	0.65
Spheroidal Particle	See Tables 3 and 4

Powder coating compositions were prepared by combining and bag-blending the components, followed by melt-extrusion. Extrudate was solidified between chilled rolls, then broken up and ground to powder. Powders were scalped at 80 mesh (180 microns) to remove coarse particles.

Coatings were prepared by applying the powdered compositions to 0.032 inch (0.081 cm) thick grounded steel panels using an electrostatic spray gun, then by baking the powder-coated panels for 10 minutes at 400°F (204°C). The thickness of the powder coatings was approximately 50 microns.

After cooling, the coatings were evaluated for gloss and smoothness. These results appear in Table 3.

TABLE 3

COATING COMPOSITIONS

Spheroidal Particle	Examples							
	1	2	3	4	5	6	7	8
Screened[1] Spheriglass™ 3000E (phr[2])	---	20	40	60	---	---	---	---
G-400 Zeeospheres™ (phr)	---	---	---	---	20	40	60	---
Screened[1] G-850 Zeeospheres™ (phr)	---	---	---	---	---	---	---	60
Properties								
Gloss	102	74	50	38	75	68	60	35
PCI Smoothness[3]	6	7	7	7	7	6	6	7
Inclined Plate Flow (mm) at 300°F (149°C)	82	75	67	55	68	54	43	48
Pencil Hardness[4]	H	H	H	H	H	H	H	H
MEK Resistance[5]	5	5	5	5	5	5	5	5
Direct Impact Resistance[6]	60	80	80	80	---	---	---	80

Notes:

(1) Particles were screened to remove particles larger than 45 μm.

(2) "phr" means parts per hundred parts resin.

(3) PCI Smoothness: By comparison to standards from 1 (heavy orange peel) to 10 (smooth).

(4) In order of increasing hardness: 2B, B, HB, H, 2H, 3H etc.

(5) Rub-off noted upon 50 double rubs with a methyl ethyl ketone-saturated cotton swab, from 1 (rub through) to 5 (no effect).

(6) Inch-lb impact which did not result in cracking using a ½" hemispherical tup.

Discussion of Results

Example 1. This example (Control) shows the high gloss of an unmodified coating.

Examples 2 and 5. Each of these examples contained 20 phr (14.5 wt%) of spheroidal particles, but of different sizes. In both instances, gloss was reduced to about the same level (74 vs. 75). However, the loss of flow in example 5 was significantly higher than in example 2, which is attributed to the fact that the spheroidal particles in example 5 had a median diameter of 5 μm, which is at the lowest end of the acceptable range.

Examples 3 and 6. Each of these examples contained 40 phr (25.3 wt%) of spheroidal particles, but of different sizes. The spheroidal particles in example 3 were more effective at reducing gloss (50 vs. 68) and also had less of a negative effect on flow (67 vs. 54 mm). These results are attributed to the fact that the spheroidal particles used in example 6 had a median diameter of 5 μm, which is below the acceptable range.

Examples 4, 7 and 8 The spheroidal particles in each of these examples comprised 60 phr (33.7 wt%) of the composition. The spheroidal particles in examples 4 and 8 were about equally effective in gloss reduction (38 and 35, respectively) and were much better than the particles used in example 7 (60). The data also show that the glass particles had less of an negative impact on flow versus the ceramic particles of approximately equal size (example 4 vs. example 8). A comparison of examples 7 and 8 demonstrates again that finer particles have a greater effect on flow reduction.

Pencil Hardness

Comparison of Examples 2-7 with Example 1 (control) showed that the addition of the spheroidal particles does not reduce pencil hardness, a measure of mar resistance.

MEK Resistance

Comparison of Examples 2-7 with Example 1 (control) showed that the addition of the spheroidal particles does not reduce MEK resistance.

Impact Resistance OHD 11/17/00 AS 11/17/00

Comparison of Examples ~~2-7~~ 2-4 and 8 with Example 1 (control) showed that the addition of the spheroidal particles has no negative effect on impact resistance.

__Examples 9-13__

Coatings were prepared, coated and evaluated as in the above examples using the spheroidal particles identified in Table 4.

TABLE 4

COATING COMPOSITIONS

Spheroidal Particles	Example					
	1	9	10	11	12	13
Goresil™ 215 (phr)	---	60	---	---	---	---
Goresil™ 525 (phr)	---	---	60	---	---	---
Goresil™ 835 (phr)	---	---	---	60	---	---
Goresil™ 1045(phr)	---	---	---	---	60	---
Goresil™ C-400(phr)	---	---	---	---	---	60
Properties						
Max. Particle Size (μm)	N/A	15	25	35	45	100
Median Particle Size (μm)	N/A	2	5	8	10	9
Gloss	96	66	59	52	42	43
Inclined Plate Flow (mm) at 375°F (149°C)	91	21	25	29	32	31
Smoothness	6	1	1	2	3	1[1]

Notes: 1. This coating exhibited "seeds" due to filler particles greater than the thickness of the coating layer.

Discussion of Results

Example 1 This example showed the high gloss of an unmodified control coating.

Gloss and Median Particle Size - Examples 9 through 12 As the median particle size increased from 2 to 10, the particles became more effective at reducing gloss. Gloss fells from 66 at 2 microns to 42 at 10 microns.

Flow and Median Particle Size – Examples 9 through 12 As the median particle size increased from 2 to 10 the particles had less effect on flow. Flow rose from 21 mm at 2 microns to 32 mm at 10 microns.

Smoothness and Median Particle Size – Examples 9 through 12 As the median particle size increased from 2 to 10 the coating became smoother. Smoothness rose from a rough 1 at 2 microns to less-rough 3 at 10 microns.

Smoothness and Maximum Particle Size – Example 13 This example showed the "seeds" which result from the presence of particles larger than the thickness of the coating (approx. 50 microns).

The conclusion from these examples is that best results with cristobalite spheroidal particles were obtained with samples which had the highest available median particle size, so long as no particles were thicker than the thickness of the coating.

__Examples 14-19__

These examples demonstrate that a properly-sized spherical filler can reduce the gloss of a variety of different coating types. Tables 5-8 list the components of the coatings that were prepared, along with gloss, smoothness and flow results. Results are summarized in Table 9.

TABLE 5

ANHYDRIDE-CURED EPOXY COATING COMPOSITION

Component	Examples 14	Examples 15
DER 6225 Epoxy Resin (DOW)	100	100
Benzophenonetetracarboxylic anhydride (Jayhawk Fine Chemical)	15	15
Zinc neodecanoate (Shepherd Chemical)	0.5	0.5
R-706 TiO2 Pigment (DuPont)	50	50
Modaflow III (Solutia)	1.3	1.3
Benzoin (Estron)	0.5	0.5
Spheriglass™ 3000E (PQ Corp.) screened at 45 μm	---	60
Properties		
Gloss (60°)	112	54
Smoothness (PCI)	8	7-8
Inclined Plate Flow (mm) at 300°F (149°C)	20	20

TABLE 6

EPOXY/POLYESTER HYBRID COATING COMPOSITION

Component	Examples 14	15
Uralac P 5998 Polyester Resin (DSM)	50	50
DER 662U Epoxy Resin (DOW)	50	50
R-706 TiO2 Pigment (DuPont)	50	50
Modaflow III (Solutia)	1.3	1.3
Benzoin (Estron)	0.5	0.5
Spheriglass™ 3000E (PQ Corp.) screened at 45 μm	---	60
Properties		
Gloss (60°)	105	39
Smoothness (PCI)	9	8-9
Inclined Plate Flow (mm) at 300°F (149°C)	88	34

TABLE 7

POLYESTER URETHANE COATING COMPOSITION

Component	Examples 14	15
Rucote 102 HYD Polyester Resin (Ruco)	100	100
Alcure 4400 Blocked Isocyanate (McWhorter)	25	25
R-706 TiO2 Pigment (DuPont)	50	50
Modaflow III (Solutia)	1.3	1.3
Benzoin (Estron)	0.5	0.5
Spheriglass™ 3000E (PQ Corp.) screened at 45 μm	---	60
Properties		
Gloss (60°)	99	31
Smoothness (PCI)	8	8
Inclined Plate Flow (mm) at 300°F (149°C)	95	77

TABLE 9

COATING SURVEY SUMMARY

Chemistry	Example	Gloss	Flow	Smoothness
TGIC Polyester	1 (control)	102	82	6
	4	38	55	7
Anhydride Epoxy	14 (control)	112	20	8
	15	54	20	7-8
Hybrid	16 (control)	105	88	9
	17	39	34	8-9
Urethane	18 (control)	99	95	8
	19	31	77	8

These data show that properly-sized spherical fillers can be reliably used to reduce gloss in a variety of powder coating chemistries.

Claims

What is Claimed is:

1. A low gloss powder coating composition comprising at least one thermosetting or thermoplastic resin and spheroidal particles, wherein said spheroidal particles comprise 5 to 50 wt% of the coating composition and wherein said spheroidal particles have a median particle diameter of greater than 10 microns and have a maximum particle diameter of about 50 microns.

2. The coating composition of claim 1, wherein the spheroidal particles have a median diameter of greater than 15 microns.

3. The coating composition of claim 1, wherein the spheroidal particles are selected from the group consisting of glass microspheres, ceramic microspheres, spheroidal minerals, polymer microspheres and metal microspheres.

4. The coating composition of claim 1, wherein the at least one thermosetting or thermoplastic resin is selected from the group consisting of: saturated and unsaturated polyesters, acrylics, acrylates, polyester-urethanes, acrylic-urethanes, epoxy, epoxy-polyester, polyester-acrylics, epoxy-acrylics, nylon, polyvinylchloride, polyethylene, polyethylene terephthalate, polybutylene terphthalate and polypropylene.

5. A process of reducing gloss of a powder coating, comprising the step of adding to a powder coating composition between 5 and 60 wt%, based on the weight of the composition, of spheroidal particles having a median particle diameter of greater than 10 microns and a maximum diameter of about 50 microns.

6. The process of claim 5, wherein the spheroidal particles have a median diameter of greater than 10 microns.

7. The process of claim 5, wherein the spheroidal particles have a median diameter of greater than 15 microns.

8. The process of claim 5, wherein the spheroidal particles are selected from the group consisting of glass microspheres, ceramic microspheres, spheroidal minerals, polymer microspheres and metal microspheres.

9. The process of claim 5, wherein the at least one thermosetting or thermoplastic resin is selected from the group consisting of: saturated and unsaturated polyesters, acrylics, acrylates, polyester-urethanes, acrylic-urethanes, epoxy, epoxy-polyester, polyester-acrylics, epoxy-acrylics, nylon, polyvinylchloride, polyethylene, polyethylene terephthalate, polybutylene terphthalate and polypropylene.

ABSTRACT OF THE DISCLOSURE

Powder coating compositions containing 5 to 60 wt% of spherical or near spherical particles having a median diameter of greater than 10, and most preferably of greater than 15 microns exhibit lower gloss without undesirable side effects such as loss of coating flow or creation of an "orange peel" effect.

PTO/SB/01A (10-00)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

As the below named inventor(s), I/we declare that:

This declaration is directed to:

☒ The attached application, or

☐ Application No. _____, filed on _____,

☐ as amended on _____ (if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/ we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including material information which became available between the filing date of the prior application and the National or PCT International filing date of the continuation-in-part application, if applicable; and

All statements made herein of my/own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

FULL NAME OF INVENTOR(S)

Inventor one: OWEN H. DECKER

Signature: Owen H. Decker Citizen of: U.S.A.

Inventor two: M. AARON SPARKS

Signature: M. Aaron Sparks Citizen of: U.S.A.

Inventor three: ______

Signature: ______ Citizen of: ______

Inventor four: ______

Signature: ______ Citizen of: ______

☐ Additional inventors are being named on _____ additional form(s) attached hereto.

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Application Number	
Filing Date	
First Named Inventor	DECKER ET AL.
Group Art Unit	
Examiner Name	
Attorney Docket Number	FA0972 US NA

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I am the:

☒ Applicant/Inventor

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
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SIGNATURE of Applicant or Assignee of Record

Name	M. AARON SPARKS
Signature	M. Aaron Sparks
Date	11/17/00 November 17, 2000

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SIGNATURE of Applicant or Assignee of Record

Name	OWEN H. DECKER
Signature	Owen H. Decker
Date	Nov. 17, 2000

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